THE IMPORTANCE OF PESTICIDES AND OTHER PEST MANAGEMENT PRACTICES IN U.S. COTTON PRODUCTION

ASSESSMENT SUMMARY

National Agricultural Pesticide Impact Assessment Program

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Chemical pesticides are widely used in U.S. cotton production to prevent yield losses from weeds, insects, diseases, and nematodes (Figure 1). Chemicals are also used widely to regulate growth and to desiccate and defoliate cotton before harvesting. The 16 cotton-producing States included in the assessment are shown in Figure 2. Approximately 45-50 million pounds active ingredient of these chemicals are used in cotton production each year, depending upon pest infestations and planted acreage. About 10 percent of the agricultural pesticide sales in the United States in 1989 were for cotton production. Consequently, U.S. Environmental Protection Agency pesticide regulatory decisions could have substantial impacts on U.S. cotton production.

The report identifies major pests and presents estimates of the use of pesticides and non-chemical pest control practices for 1989-90. The report addresses the impacts of losing the use of specific pesticides and major pesticide groups, including the use of alternative control practices, yield losses, and economic effects.

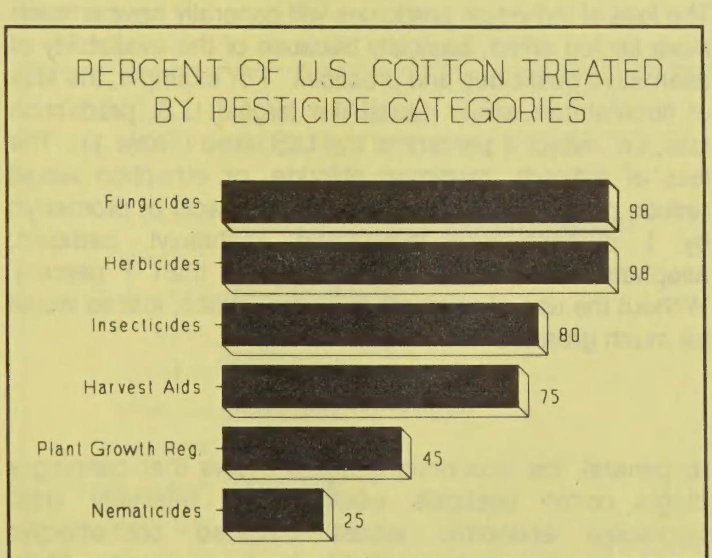

Figure 1

Major Pests

Cotton specialists ranked pests by economic importance. Across the cottonbelt, the most destructive disease complex is seedling diseases, followed by nematodes and *Verticillium* wilt. The most troublesome weeds are pigweed and the members of its genus, followed by sorghum and morningglory species. Among insects, the worst pests are bollworms/budworms, followed by boll weevils and thrips. However, these may not be the most injurious pests in some regions or localities.

Use of Chemical and Nonchemical Practices

Herbicide and fungicide seed treatments are used on 98 percent of cotton acreage, insecticides on 80 percent, harvest-aid chemicals on 75 percent, growth regulators on 45 percent, nematicides on 25 percent, and foliar fungicides on less than 1 percent (Figure 1). National use estimates for specific pesticides and major groups are shown in Table 1 and Figures 3, 4, and 5.

Nonchemical practices are widely used and are important adjuncts to the chemical tools available for cotton pest management. Important practices include mechanical cultivation on 94 percent of U.S. cotton acreage, conservation of natural enemies on 75 percent, scouting on 62 percent, resistant cultivars on 61 percent, seed bed design on 54 percent, crop residue reduction on 49 percent, crop rotation on 31 percent, date of planting on 29 percent, environmental defoliation or freeze on 29 percent, and earlier maturing varieties on 27 percent.

Yield Losses

The report estimates that the loss of insecticides, herbicides, fungicides, harvest-aid materials, growth regulators, and nematicides would result in catastrophic yield losses: 28 percent of the U.S. cotton crop would be lost without insecticides, 27 percent without herbicides, 18 percent without fungicides, 17 percent without harvest-aid materials, 5 percent without plant growth regulators, and 2 percent without nematicides. There would also be quality losses such as reduced lint strength and grassy bales.

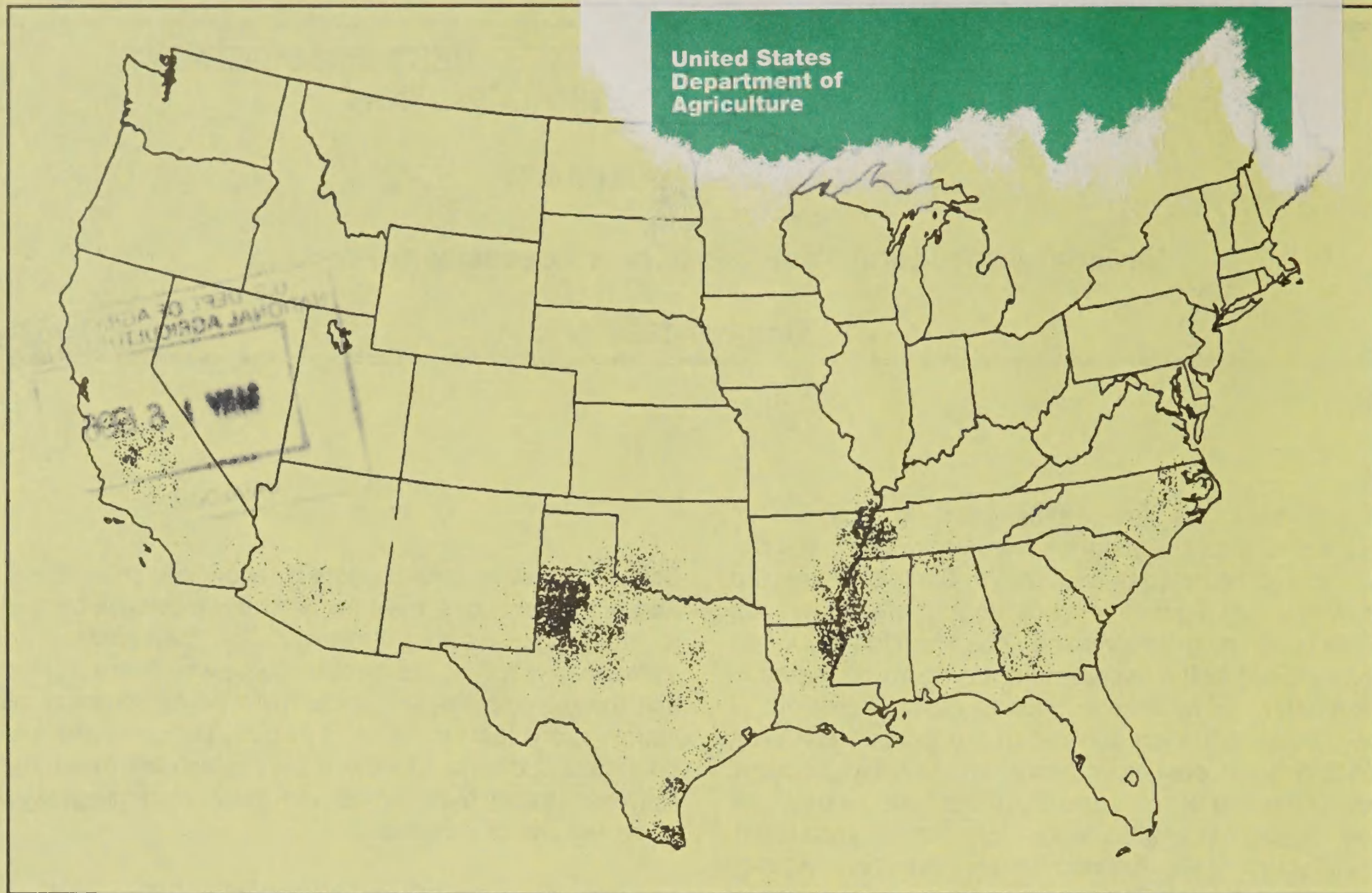

Figure 2 Source: National Cotton Council of America

* Each dot equals 1000 planted acres.

Other secondary effects include soil erosion due to increased tillage, increased hand labor, delayed harvest, increased pest problems, reduced harvester efficiency, and increased production costs.

The loss of major chemical groups would also have a significant effect on cotton yields (Figure 6). The loss of pyrethroid insecticides would reduce the U.S. cotton crop by 11 percent, organophosphate insecticides by 8 percent, dinitroaniline herbicides by 7 percent, substituted urea herbicides by 5 percent, carbamate insecticides by 4 percent, organic arsenical herbicides by 3 percent, and triazine herbicides by 2 percent (Table 1).

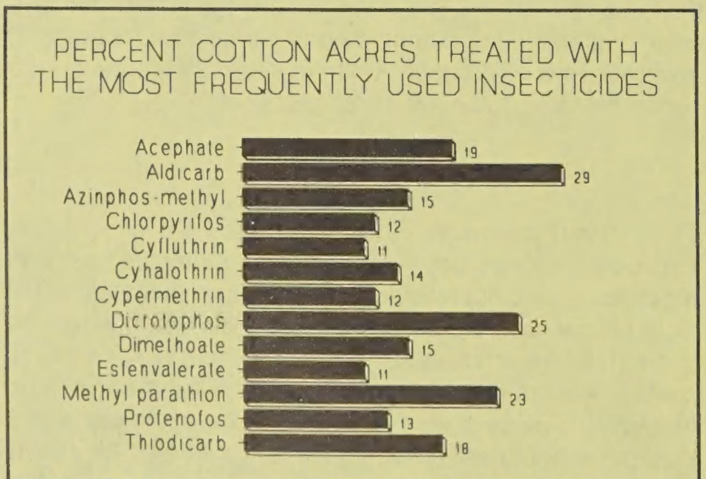

Figure 3

The loss of individual pesticides will generally have a much more limited effect, basically because of the availability of alternative pesticides and practices. For example, the loss of fluometuron would cause the largest U.S. production loss, i.e., about 4 percent of the U.S. crop (Table 1). The loss of aldicarb, mepiquat chloride, or ethephon would reduce production by 2 percent; arsenic acid or prometryn by 1 percent; and thidiazuron, metalaxyl, carboxin, acephate, trifluralin, or PCNB by less than 1 percent. Without the use of alternatives in their place, losses would be much greater.

Economic Impacts

In general, the economic analysis shows that banning a single cotton pesticide would cause relatively small aggregate economic losses because cost-effective alternatives would be available in many areas. Major exceptions are that annual domestic economic losses would be about $110 million for banning fluometuron, a herbicide, and $90 million for aldicarb, an insecticide/nematicide (Table 1).

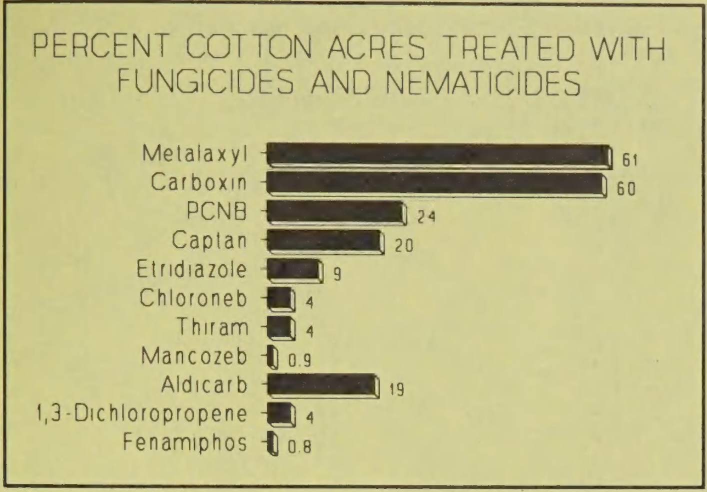

Figure 4

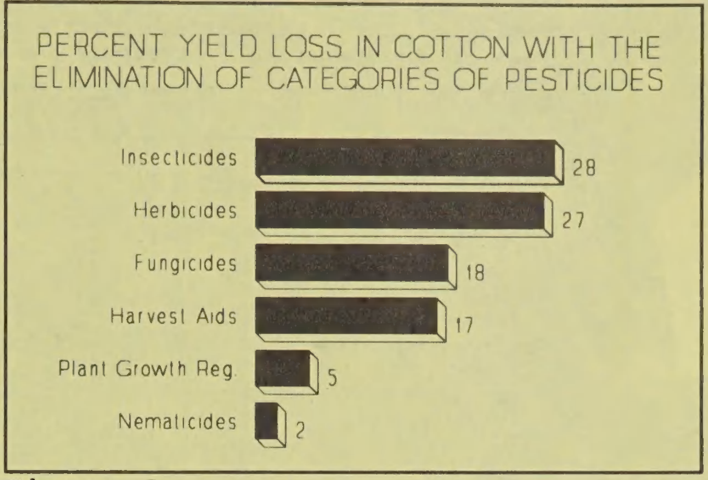

Figure 6

However, losing the use of major pesticide families or groups of alternatives for pest problems because of regulatory actions or pest resistance would have much larger effects on cotton production and consumption (Table 1). For example, the loss of all pyrethroid insecticides would result in an economic loss of about $600 million, while the loss of any single pyrethroid would have an annual economic loss of $5 million or less. Similar results would occur with the loss of all seed treatment fungicides; desiccants and defoliants; carbamate and organophosphate insecticides; and dinitroaniline, organic arsenical, and triazine herbicides.

These results demonstrate that if chemical alternatives are sequentially removed by regulatory action or become ineffective due to resistance, at some point the benefits of the remaining alternatives will increase dramatically even though their efficacy may remain unchanged. The risk-benefit trade-off for individual chemicals is affected by the sequence of regulatory actions to add or remove alternatives.

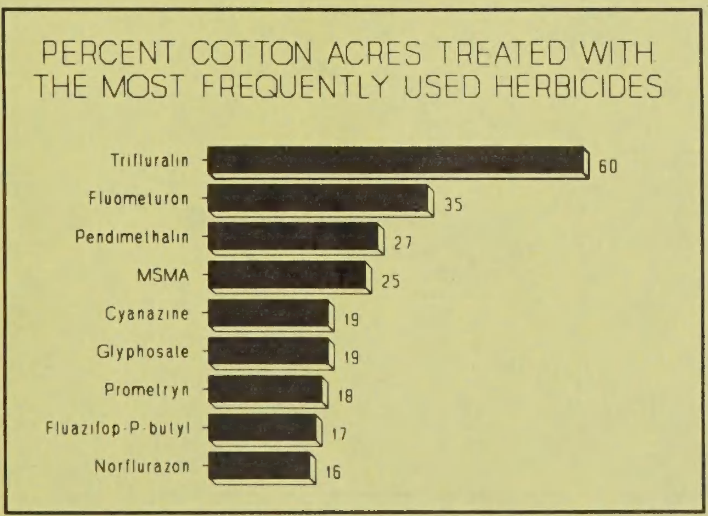

Figure 5

Bans of major cotton pesticide groups, fluometuron or aldicarb, could result in cotton production decreases large enough to increase cotton prices and cause consumer losses. The higher prices would increase revenues to cotton producers not using the affected pesticide or group.

However, the users of banned pesticides would incur financial losses, sometimes large, even though prices would increase.

Some regions could suffer severe financial losses while others could incur little impact. For example, the voluntary cancellation of arsenic acid, a desiccant, caused an estimated economic loss of $50 million to producers in Texas and Oklahoma, but had little impact elsewhere. In general, the Delta and Southeastern States would be more vulnerable than other U.S. cotton-producing regions to economic losses resulting from regulatory actions on or pest resistance to cotton pesticides, particularly major pesticide groups, because these two regions generally have more severe pest problems and rely more heavily on pesticides than other cotton-producing regions. Also, isolated groups of producers could suffer severe financial losses because the alternatives for their atypical pest problems are not effective, even though the aggregate economic loss of the regulatory action would be small.

Table 1-- Cotton pesticides: cotton acreage treated; yield losses and economic loss if the pesticide or group is not available

Chemical(s) Lost	Acreage Treated	Yield loss/ planted acre	Net domestic loss
	Percent	Percent	$ Millions
INSECTICIDES			
Pyrethroids	55	-11	-607
Cyhalothrin	14	*	-2
Cypermethrin	12	*	-3
Esfenvalerate	11	*	-2
Permethrin	2	*	-1
Organophosphates	70	-8	-377
Acephate	18	*	-28
Azinphosmethyl	15	*	-5
Dicrotophos	14	*	-15
Dimethoate	15	*	-11
Disulfoton	5	*	**
Malathion	5	*	-1
Methamidophos	7	*	-12
Methyl parathion	23	*	-13
Phorate	2	*	-1
Profenofos	13	*	-6
Sulprofos	5	*	-2
Carbamates	42	-4	-233
Aldicarb	33	-2	-89
Methomyl	7	*	-3
Thiodicarb	18	*	-3
Others			
Dicofol	7	*	-6
Propargite	5	*	-2
HERBICIDES			
Dinitroanilines	89	-7	-336
Pendimethalin	28	*	-3
Trifluralin	61	*	-24
Organic arsenicals	32	-3	-141
DSMA	8	*	-2
MSMA	25	*	-6
Triazines	38	-2	-108
Cyanazine	20	*	-14
Prometryn	18	-1	-46
Substituted Ureas	33	-5	-144
Fluometuron	29	-4	-106
Diuron	8	*	-10
Others			
Fluazifop	18	*	-19
Glyphosate	19	*	-19
Norflurazon	16	*	-4
Sethoxydim	9	*	-4
FUNGICIDES			
Seed treatments	98	-18	-608
Captan	20	*	-8
Carboxin	59	*	-24
Etridiazole	9	*	-2
Metalaxyl	61	*	-69
PCNB	21	*	-19
Thiram	4	*	-6
Mancozeb 1/	<1	*	-3
DESICCANTS AND DEFOLIANTS			
All Desiccants and Defoliants	75	-17	-628
Arsenic acid 2/	12	-1	-52
Dimethepin	4	*	-2
Endothall	4	*	-2
Paraquat dichloride	17	*	-7
Phosphorotrithioate	35	*	-14
Sodium chlorate	16	*	-8
Thidiazuron	22	*	-32
PLANT GROWTH REGULATORS			
Ethephon	26	-2	-32
Mepiquat chloride	29	-2	-43

* = Yield loss of less than 1 percent.
** = Negligible.
1/ No longer registered for foliar application.
2/ Voluntarily canceled.